



UvA-DARE (Digital Academic Repository)

Molecular and biochemical studies of fragrance biosynthesis in rose

Sun, P.

Publication date

2017

Document Version

Other version

License

Other

[Link to publication](#)

Citation for published version (APA):

Sun, P. (2017). *Molecular and biochemical studies of fragrance biosynthesis in rose*.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

Université Jean Monnet Saint-Étienne
University of Amsterdam

Discipline: Biologie et Physiologie Végétales
(Plant Biology and Physiology)

**Etude de gènes impliqués dans la biosynthèse du
parfum chez la rose, *Rosa x hybrida***

**Molecular and biochemical studies of fragrance
biosynthesis in rose**

Pulu Sun



Soutenue le 17 Mars 2017 devant le jury:

Mme Danièle WERCK-REICHHART, Directrice de recherche CNRS, Strasbourg	Rapporteuse
M. Harro BOUWMEESTER, Professor, University of Amsterdam	Rapporteur
M. Jérémy CLOTAULT, Maître de Conférences, Université d'Angers	Examineur
Mme Petra BLEEKER, Assistant Professor, University of Amsterdam	Examinatrice
M. Philippe HUGUENEY, Directeur de recherche INRA Colmar	Membre invité
M. Rob SCHUURINK, Associate Professor, University of Amsterdam	Co-directeur de thèse
M. Michel HARING, Professor, University of Amsterdam	Directeur de thèse
Mme Sylvie BAUDINO, Professeur, Université Jean Monnet Saint-Étienne	Directrice de thèse

**Molecular and biochemical studies of
fragrance biosynthesis in rose**

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. ir. K.I.J. Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,

in het openbaar te verdedigen aan de universiteit Jean Monnet St Etienne

op vrijdag 17 maart 2017, te 14:00 uur

door

Pulu Sun

geboren te Guangdong, China

Promotiecommissie:

Promotor: Prof. dr. M.A. Haring, Universiteit van Amsterdam

Promotor: Prof. dr. S. Baudino, Université Jean Monnet St Etienne

Copromotor: Dr. R. C. Schuurink, Universiteit van Amsterdam

Overige leden: Prof. dr. H.J. Bouwmeester, Universiteit van Amsterdam

Dr. P.M. Bleeker, Universiteit van Amsterdam

Prof. dr. D. Werck-Reichhart, Université de Strasbourg

Dr. J. Clotault, INRA Angers

Dr. P. Hugueney, INRA Colmar



Designed and painted by Lu Zhang

They are :

Rosa x wichurana (Left bottom)

Rosa chinensis cv. 'Old Blush' (Center)

Rosa x hybrida cv. 'Akito' (Right top)

Rosa x hybrida cv. 'The McCartney rose' (Left top and right bottom)

Table of contents

Acknowledgements	1
Abstract	3
Résumé	4
Samenvatting	5
Chapter 1 General introduction	7
Past and present of rose fragrance	9
Article: “My Way: noncanonical biosynthesis pathways for plant volatiles”	18
Research objectives and outlines	33
Chapter 2 Biosynthesis of monoterpene scent compounds in roses	35
General outline	37
Article: “Biosynthesis of monoterpene scent compounds in roses”	38
Supplementary materials for Chapter 2	45
Chapter 3 Nudix hydrolase 1 proteins are key factors of the biosynthesis of both monoterpenoids and sesquiterpenoids in roses	73
General outline	75
Nudix hydrolase 1 proteins are key factors of the biosynthesis of both monoterpenoids and sesquiterpenoids in roses	76
Additional experiments	103
Supplementary materials for Chapter 3	109
Chapter 4 Transcriptional regulation of <i>Nudix hydrolase 1</i> in roses	127
General outline	129
Transcriptional regulation of <i>Nudix hydrolase 1</i> in roses	130
Chapter 5 <i>De novo</i> transcriptome assembly and RNA-Seq analysis for rose petals to discover scent-related genes and transcription factors	153
General outline	155
<i>De novo</i> transcriptome assembly and RNA-Seq analysis for rose petals to discover scent-related genes and transcription factors	156
Supplementary materials for Chapter 5	173
Chapter 6 General discussion	197